FINAL REPORT ON CHEMICAL COATER PROJECT REDUCTIONS IN WASTE VOLUMES ACHIEVED (IWDP PROJECT)

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Report prepared by:

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Continuous Colour Coat Ltd

Report prepared for:

Ontario Ministry of Environment and Energy

DISCLAIMER

METAL KOTING
CONTINUOUS COLOUR COAT LIMITED

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Date: Oct 10 , 1996

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Abstract:

Metal Koting generally produces three products: electroplated zinc onto cold-rolled steel, painted, and laminated metal. The Dry-in-Place Chemical Coater Project entailed the installation of a chemical roll coater that directly applies a chemical to the metal strips, in order to promote paint adhesion and corrosion resistance. A dryer was also installed to dry the applied treatment, before painting. The objective was to replace the existing spray chemical treatments, which by their nature required continual draining, or bleeding, to control contamination. These bleed streams were sent off-site for subsequent treatment at significant expense, as they were considered hazardous waste. The new dry-in-place treatment generates no waste since all of the chemicals remain on the product.

This project was successful in reducing waste, which resulted in appreciable cost savings. Since installation of the coater most of our customers have been converted to the new treatment and in the last year a reduction of 82% for acid waste and 63% in alkaline waste was achieved from the paint line operation.

Introduction:

The existing spray chemical treatments at the Paint Line generated large amounts of hazardous waste (bleeds and dumping of entire tank) which were shipped off-site for disposal at considerable expense. In addition, rinse waters were being sent to the sewer containing contamination levels at or below sewer discharge limits. These factors represented considerable environmental risk for our company, (storage and shipment of large quantities of hazardous waste, sewer discharge levels that hampered water conservation efforts).

The original proposal included the following modifications to accommodate the new technology: removal of existing tanks and spray housings, mounting of the dry-in-place chemical coater, installation of drives and electrics, tie in to line controls, installation of chemical feed and control, and a dry-off oven to dry the coating.

By installing the above equipment the following was to be achieved:

1. Elimination of all acid waste from the treatment of aluminium (chromic waste).
2. Elimination of all waste from the final chromate sealer rinse (Parcolene 62, mixed Cr^{+3}, Cr^{+6})
3. Initial elimination of 50% of alkaline waste from alkaline Bonderite 1303 mixed metal oxide treatment (Cobalt/Iron) for hot dipped galvanized and electrogalvanized, with total changeover subject to customer approval.
4. Total elimination of waste from the treatment of cold rolled steel (iron phosphate).

The Project:

Selection of Process:

The technology to replace the spray treatments has been around for some time, particularly in the aluminium industry. There has been very little work on multi-metal treatment lines. Through much discussion with chemical suppliers, physical line trials using our paint coaters in 1992 and 1993, a visit made to an aluminium line with a coater, and examination of physical results by ourselves and our paint suppliers the following process was decided upon to meet our needs.

A section of the spray treatment line is to be removed and a reverse roll chemical coater was to be added. The reverse roll coater allows the uniform distribution of chemical necessary to meet the consistent adhesion and final corrosion characteristics of our product.

The chemical selected for use was Bonderite 1402 since it offered good adhesion characteristics on all metal substrates used at Metal Koting and did not require pre-curing or baking prior to painting. This chemical does however require a dry off oven to drive off free water prior to painting. The dryer would then be mounted immediately after the coater to dry the strip before contacting any carrier rolls which might disturb the deposited chemical film. Following the dryer the strip is carried to the prime coater for painting.

Selection of Equipment:

The essential components are:

1. Stitch (seam between two metal strips) Detection System: necessary to automate operation of coater.
2. Chemical Coater: necessary to apply the coating
3. Strip Dryer: necessary to dry the coating prior to painting

Engineering of the system was awarded to Acres International with Bob Morgan as project co-ordinator. A specification for the coater and the subsequent drying equipment was prepared and sent to prominent equipment suppliers for these items. A quotation was received from GFG and Black Brothers for the coater. Pricing was similar for both suppliers, with GFG winning out due to a more thorough quotation. Coater drive controls and stitch detection system were given to Reliance to remain consistent with existing electrical drive components at Metal Koting. A number of options were explored for the dryer including: infra-red, electric and gas-fired; conventional recirculation gas-fired, and a recirculation design using waste heat from our hot oil heat recovery system. In the end the heat recovery design (by Proenco Systems Ltd.) offered no operating cost for a similar price and was selected.

Implementation:

Once equipment was selected dimensions were obtained and detailed engineering drawings were prepared for the installation (see Appendix- General Arrangement 382E091). The installation was originally scheduled to proceed at the winter shutdown (Christmas '94); however, due to delays in equipment delivery this was delayed several times and to avoid too much business disruption, final installation occurred at summer shutdown July 1995. Some work was done at the winter shutdown to make room for the coater including removing of tanks and spray housing and extending the structural platform to hold the coater and the dryer. This did make operation difficult during the intervening months in that we had to double up using one spray housing for multiple treatments.

The coater , dryer and stitch detection system were installed in July of 1995. The original selection of the dryer was an infra-red, which required no external exhaust. In the final installation, however, a hot oil heat recovery dryer was chosen, which required an external exhaust. As a result, a Ministry of Environment and Energy certificate of approval was obtained for this exhaust in late August, 1995, delaying the start-up.

Commissioning the Equipment:

Engineers from GFG and Reliance attended the start-up of the coater in late August. Operators and maintenance people were trained in procedures specific to this equipment.

The coater and dryer were started up without too much difficulty in September 1995. Right away much of the regular production was switched to the new dry-in-place treatment. Some customers required initial trial quantities before endorsing the treatment switch.

Some difficulty was experienced with the initial location of the stitch detector. It was located some distance in front of the coater (100'). This posed a problem when running shorter test strips. The detector was relocated closer to the coater.

Trials were conducted for a customer who requires a product with unusual corrosion protection characteristics for unusual exposure conditions. For this customer we were unable to switch from the existing zinc phosphate/chromate sealer rinse treatments. At present we are sending these wastes off-site for disposal. However, with the volume of waste being substantially reduced from the paint line, it is believed that we may treat these wastes internally in the future.

Some initial problems were experienced with heavier gauge metal, such as obtaining uniform coverage. Increasing roll pressures did not work well. The chemical application roll coverings were periodically deteriorating at heavy pressures. A decision was made to switch to a different roll covering.

At the same time, a literature search was conducted to try and determine the cause of the problem. This search indicated that the original roll speed specification was inadequate (originally speed range was 90-130% of process line speed) causing chattering and roll damage. More speed was required. By making adjustments to controls, a speed of just over 150% is achievable. This is now normal setting (at max.). For a time old spray treatments were still used on difficult materials (heavy gauge or wavy

edge). Applicator roll damage caused material rejection due to rubber particle contamination and higher scrap due to coater drives tripping out. Improper programming of the drive ammeters contributed to a failure to detect overload problems.

Filtration of the dry-in-place chemical was instituted to remove rubber particles or dried chemical particles.

In addition to changing the roll covering material the durometer (hardness) of the rolls was decreased to achieve better coverage on strip with wavy edge or shape problems.

By the end of January, 1996, most of the operational problems had been sorted out and the coater was presently functioning well, coating 90% of throughput. Still, one conventional spray treatment remains, as described earlier, a zinc phosphate treatment necessary to pass the adhesion and corrosion requirements of a single product.

Discussion of Results and Observations:

Attached is a summary (Figure 1) illustrating the impact of the installation of the chemical coater on wastes generated from our Paint Line. As illustrated, the use of the dry-in-place coater has greatly reduced the volume of wastes generated from our paint line. Calculated percentage reductions were 82% and 63% for acid and alkaline wastes respectively. Reduction in wastes sent out under manifest for disposal total 1,665,387 litres compared to the previous year. Since manifest shipments after the coater installation included disposal of waste from existing treatments no longer used, it is anticipated that these figures will improve. Production for these two periods varied little, 11.4 million ft^2 for the previous year and 11.9 million ft^2 for the present year.

In addition to the above, the reduction in contaminants to the rinse water streams was sufficient to safely introduce these streams to existing galvanizing waste treatment system. This has essentially eliminated phosphorus, zinc and nickel levels from our paint line effluent.

Figure 2 is a flow schematic comparing the waste streams of the former spray application to that of the present arrangement with the chemical coater.

Now that the remaining spray treatment use is small (only 3% of plant throughput) there is a plan to pipe all chemical waste from the paint line to the galvanizing line waste treatment. This will eliminate chemical waste altogether from the sanitary sewer stream..

Project Economics:

Original Project Estimate:	$ 570,400
Actual Costs:	$ 704,542.34

Reasons for Cost overrun:

Some costs were incurred due to equipment delivery delays, necessitating splitting installation into two parts. More overtime was required for contractors than was forecast, and installation costs were underestimated in original proposal.

Cost savings since installing the Chemical Coater:

Chemical Consumption:

Initially savings in chemical consumption were not expected to be high. But, in practice, coating weights had to be reduced below supplier specification to achieve adhesion results.

Chemical Costs:

in the previous year : $ 4.44/1000 ft^2
In the present year: $1.84/1000 ft^2
Total Savings based on 11 million ft^2 $ 286,000

Chemical Haulage and disposal Savings:
Waste diverted: 1.67 million litres @ $ .145/litre= $ 241,715

Total Savings in first year: $527,715 Project Payback: 1.34 yrs

Results and Conclusions:

1. It was not possible to totally eliminate waste from the Paint Line by utilizing this new technology. Alkaline waste is still produced from the alkaline cleaning section of the line. Some acid waste is still produced from the zinc phosphate treatment and chromate rinse. At present we are arranging to treat these on-site.

2. Figure 1 compares the present volume of waste generated from the paint line to the year previous. Reductions in manifested waste shipments averaged 82% for acid waste and 63% for alkaline waste. A total of 1.67 million litres of waste were eliminated.

3. Compare reductions to objectives:
   - All waste has been eliminated from the treatment of aluminium.(6.1% of throughput)
   - Objective was to eliminate all waste from Parcolene chromate sealer, however only 97% reduction was achieved due to customer requirement.
   - Objective was 50% initial diversion with gradual conversion to 100% diversion of alkaline waste from Bonderite 1303 treatment. In fact, elimination of all waste from this source was virtually immediate.
   - Elimination of all waste from iron phosphate treatment for cold rolled was achieved.

4. Problems with conversion to new treatment included:

- Difficulty in detecting areas of uncoated or skipped treatment
- Reduction in coating weight targets to below original specifications from chemical supplier were necessary to achieve adhesion characteristics required for our product.
- Roll speeds had to be increased above original design to avoid chattering and roll damage.
- The method of application by roller, not spray, meant that careful set-up of the coater and correct roll hardness were important to obtain good coating quality..

5. From an economic standpoint, even with the cost overrun the savings in chemical consumption and reduction in waste haulage and disposal give the project a payback of 1.34 years.

6. List of Do's & Don'ts:

Do's:

- Research all applicable literature on the application of the technology being considered. We made a mistake with regard to roll speeds not recognizing the problem when it occurred and by not specifying equipment properly in the beginning. Our having considerable experience with reverse roll coating using solvent-based paints blinded us to problems of applying water-based chemical by this technique.

- Have contingencies worked out well in advance to account for late equipment deliveries.

- Stay on top of the implications of any changes in direction as the project progresses. Waiting for a Certificate of Approval caused weeks of delay in start-up.

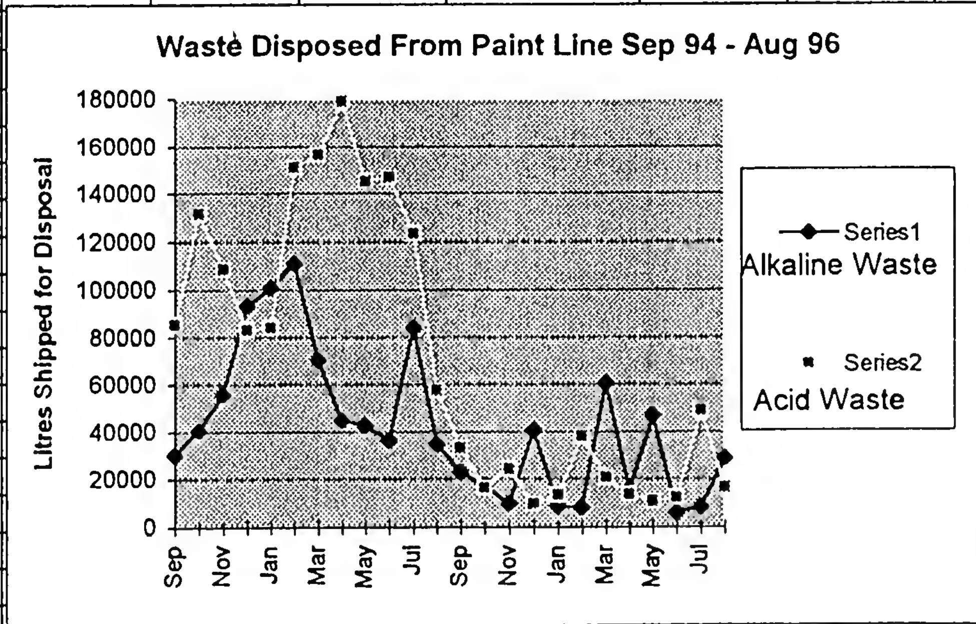
Don'ts:

- Do not accept chemical supplier's recommendations at face value. Their specifications are broadly based and may not meet your specific needs. In our case, considerable reduction in chemical usage was required to meet adhesion characteristics required where supplier recommendations were based on corrosion protection.

- Do not attempt to save money by putting in a Programmable Logic Controller (PLC) that is incompatible with existing control systems. By spending a little more up front, problems with the stitch detection system could have been avoided and integration with other controls would have been a lot easier.

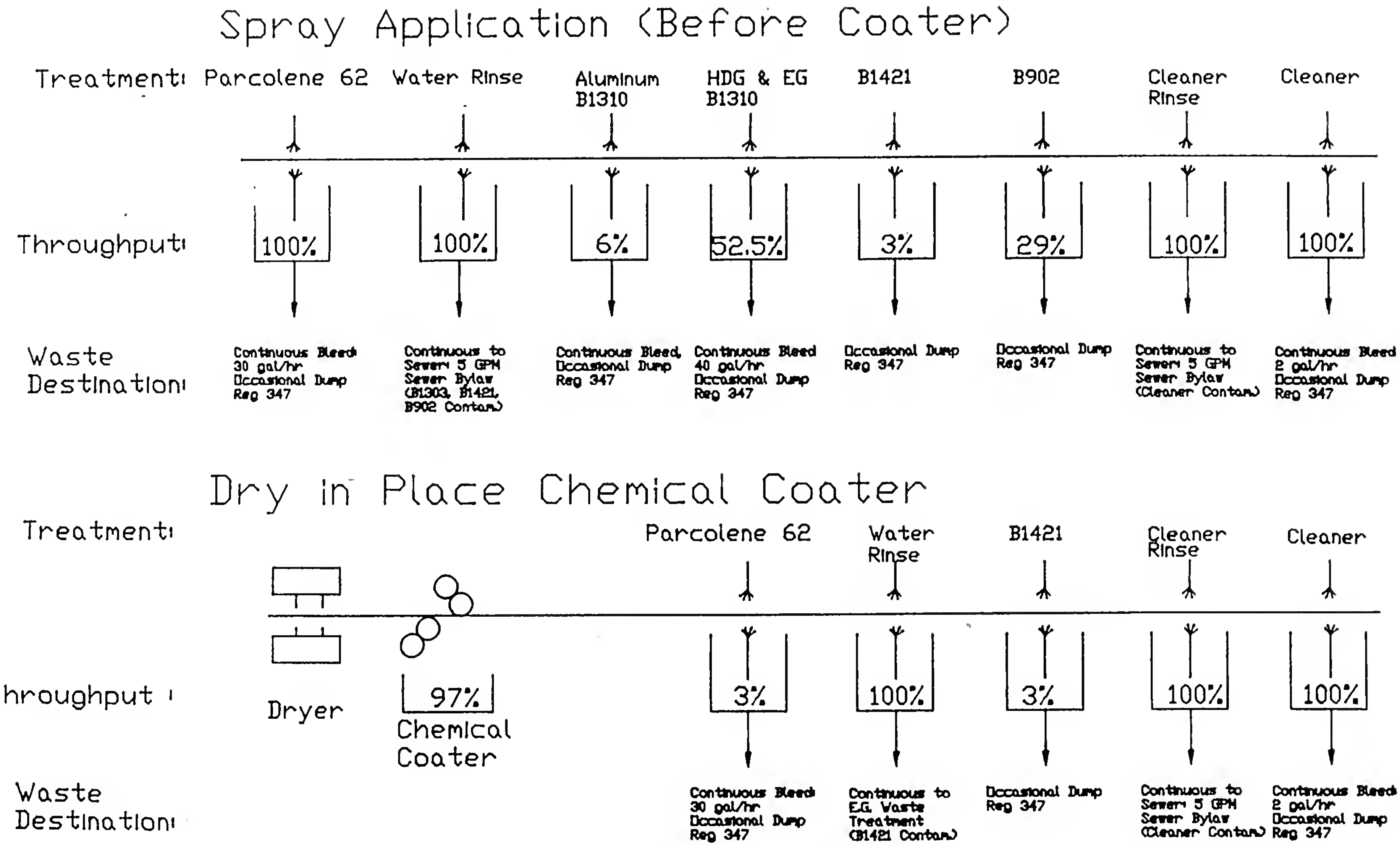
Figure 1

month 94/95	Paint Line Alk 121C	Paint Line Acid 112C
Sep	30088	85352
Oct	40449	131256
Nov	55870	108535
Dec	93170	82814
Jan	100945	83908
Feb	110880	150983
Mar	70221	156334
Apr	44949	178786
May	42618	145041
Jun	36431	146572
Jul	84141	123157
Aug	34850	57240
Coater Installed & Begin Operation Sep 95		
month 95/96		
Sep	22933	33300
Oct	17192	16200
Nov	9863	24210
Dec	40500	9450
Jan	8300	13300
Feb	8100	38042
Mar	60666	20793
Apr	14910	13637
May	46900	10568
Jun	6070	12300
Jul	8150	48900
Aug	28719	16200



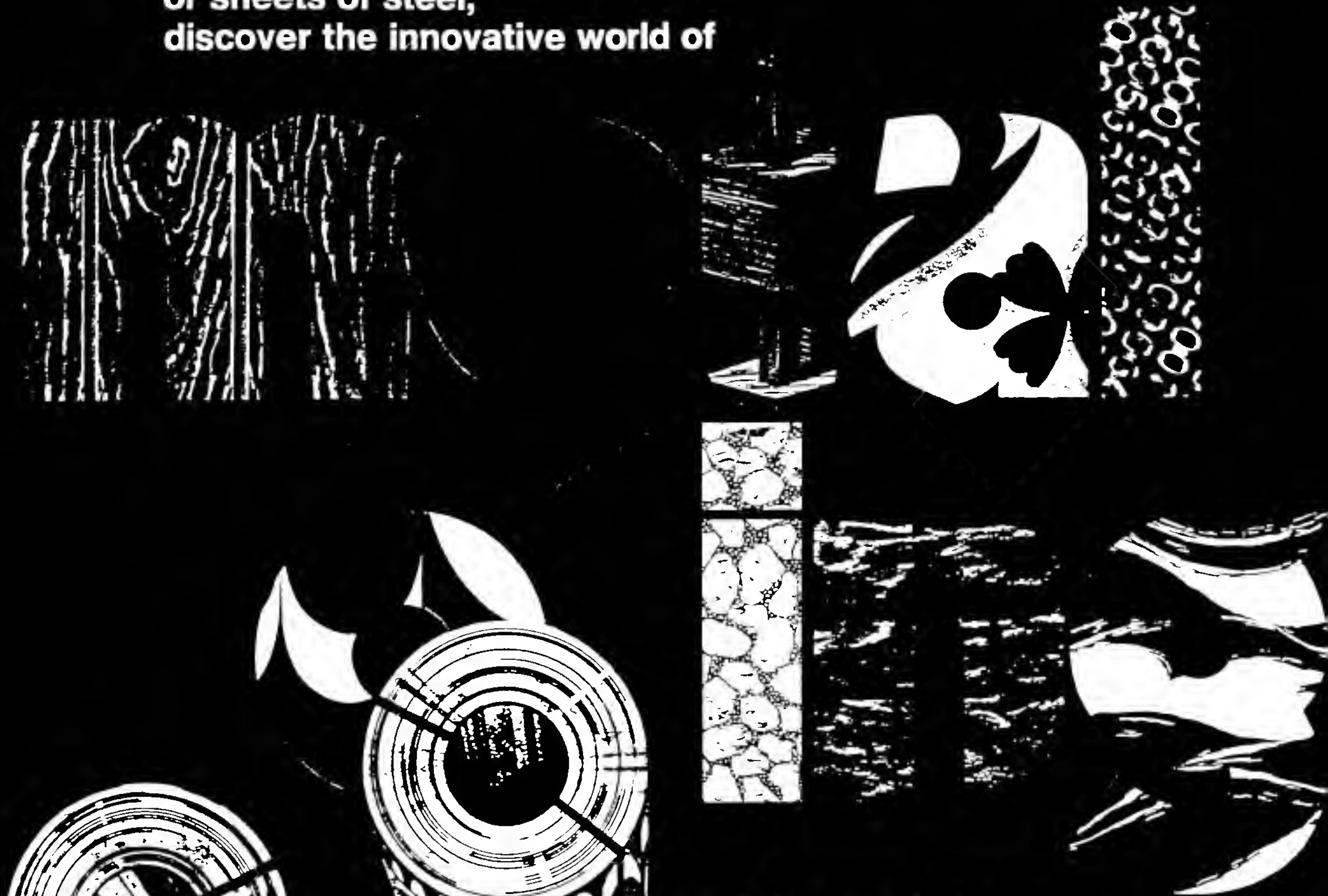
	Dry in Place Coater Installed and running in Sep 1995			
	Monthly	Monthly		
	Avg 94/95	Avg 95/96	%Reduction (monthly average)	
112C	120831.5	21408.33	**82.28**	
121C	62051	22691.92	**63.43**	
	Volume of Waste Diverted:			
Sum94/95	Sum95/96			
2194590	529203	**1,665,387**	**LITRES**	

Figure 2:



Spray Application (Before Coater)
Treatment:
Parcolene 62
Water Rinse
Aluminum B1310
HDG & EG B1310
B1421
B902
Cleaner Rinse
Cleaner
Throughput:
100%
100%
6%
52.5%
3%
29%
100%
100%
Waste Destination:
Continuous Bleed 30 gal/hr Occasional Dump Reg 347
Continuous to Sewer: 5 GPM Sewer Bylaw (B1303, B1421, B902 Contam.)
Continuous Bleed, Occasional Dump Reg 347
Continuous Bleed 40 gal/hr Occasional Dump Reg 347
Occasional Dump Reg 347
Occasional Dump Reg 347
Continuous to Sewer: 5 GPM Sewer Bylaw (Cleaner Contam.)
Continuous Bleed 2 gal/hr Occasional Dump Reg 347
Dry in Place Chemical Coater
Treatment:
Parcolene 62
Water Rinse
B1421
Cleaner Rinse
Cleaner
hroughput :
Dryer
97%
Chemical Coater
3%
100%
3%
100%
100%
Waste Destination:
Continuous Bleed 30 gal/hr Occasional Dump Reg 347
Continuous to E.G. Waste Treatment (B1421 Contam.)
Occasional Dump Reg 347
Continuous to Sewer: 5 GPM Sewer Bylaw (Cleaner Contam.)
Continuous Bleed 2 gal/hr Occasional Dump Reg 347

If your product is made from coils or sheets of steel, discover the innovative world of



Before a product is even manufactured, we can electro-galvanize, pretreat, paint, decorate or vinyl laminate it for maximum beauty and durability. Or we *preprint* numerous, three dimensional motifs utilizing Metal Koting's exclusive, new, tricolour process.

Discover the innovative world of Metal Koting for yourself. A world of fascinating colour, incredible durability . . . rich wood grains, subtle leather geometric designs never before possible. All pre-finished on coils of steel and aluminum up to 60" wide.

Metal Koting's world is truly innovative.

It's a world of products as diverse as appliance cabinets, swimming pool walls, automobile dashboards, office furnishings, lighting fixtures, garage doors, toys, license plates, garbage cans – etc., etc., etc. All prefinished on coils of steel or aluminum.

METAL KOTING
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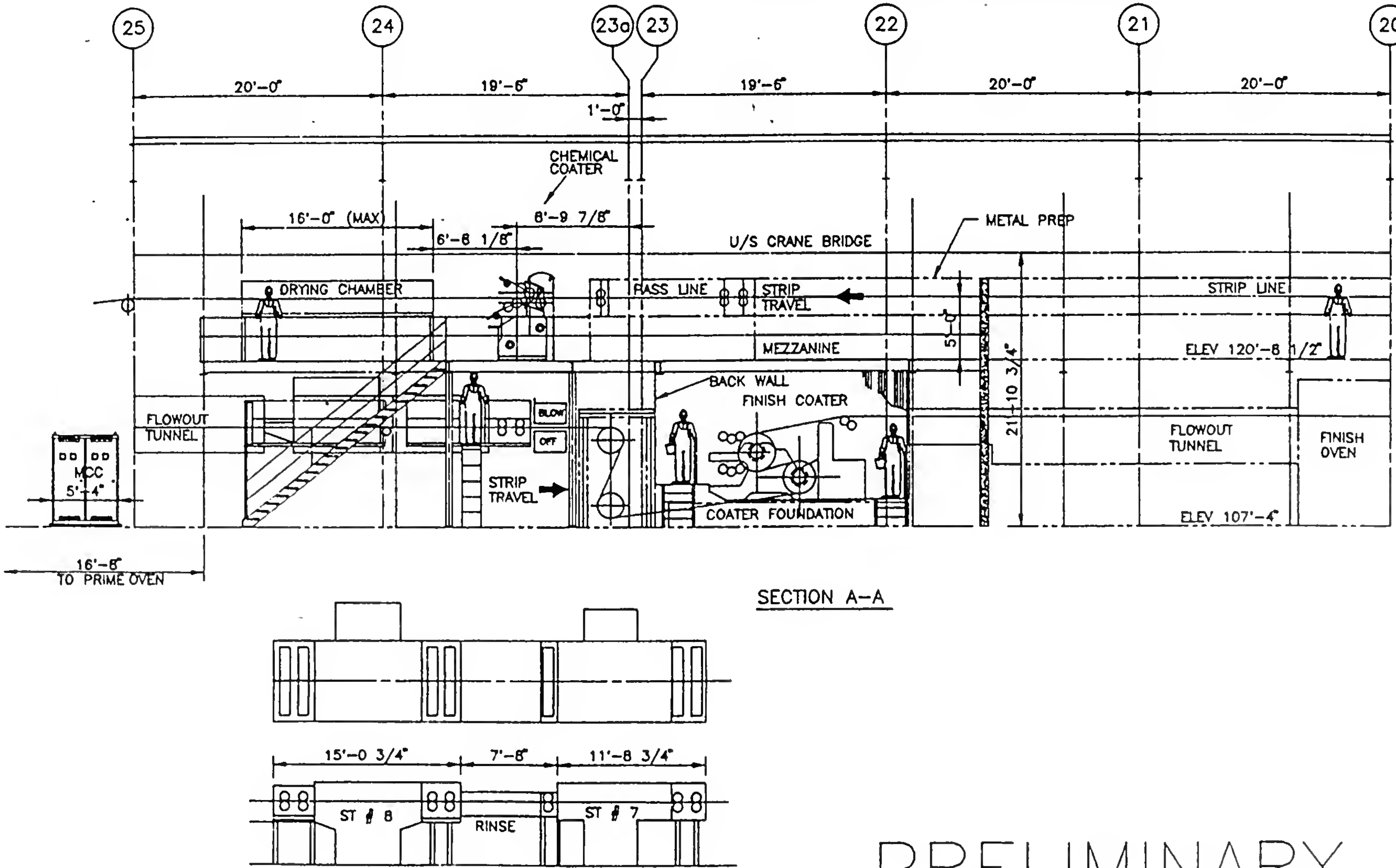
Appendix



PRELIMINARY

REV	DESCRIPTION	DATE	DN

ITEM | PART No. | DESCRIPTION (FINISHED SIZE) | MATERIAL | QTY.

DO NOT SCALE

ALL DIMENSIONS IN INCHES UNLESS OTHERWISE SPECIFIED

REMOVE ALL SHARP EDGES (+/-) .010 FINISHED FRACTION

ASSY USED ON

METAL KOTING
CONTINUOUS COLOUR COAT LTD.
1430 MARTIN GROVE ROAD
REXDALE, ONT. M9W 4Y1

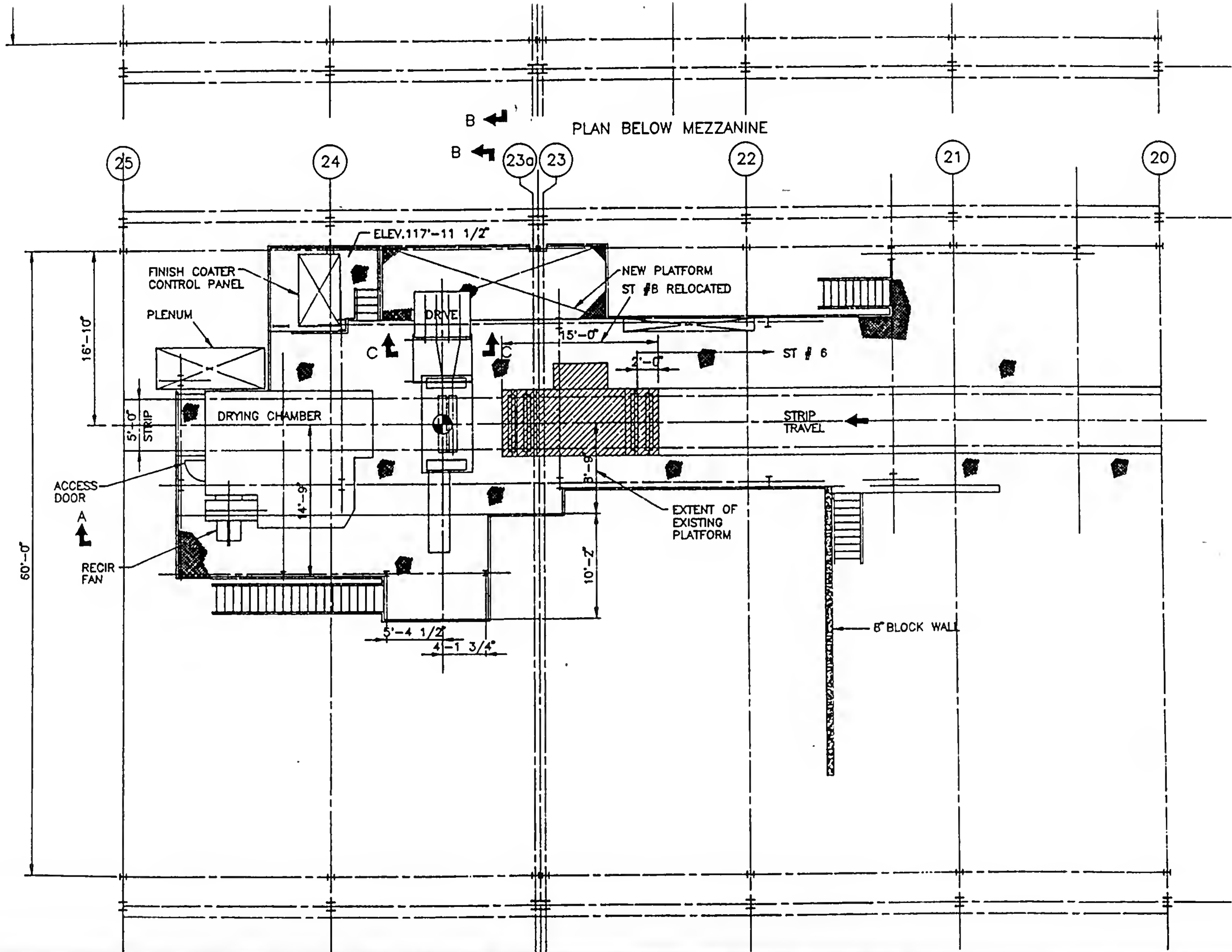
TITLE: PAINT LINE CHEMICAL COATER GENERAL ARRANGEMENT

MATERIAL

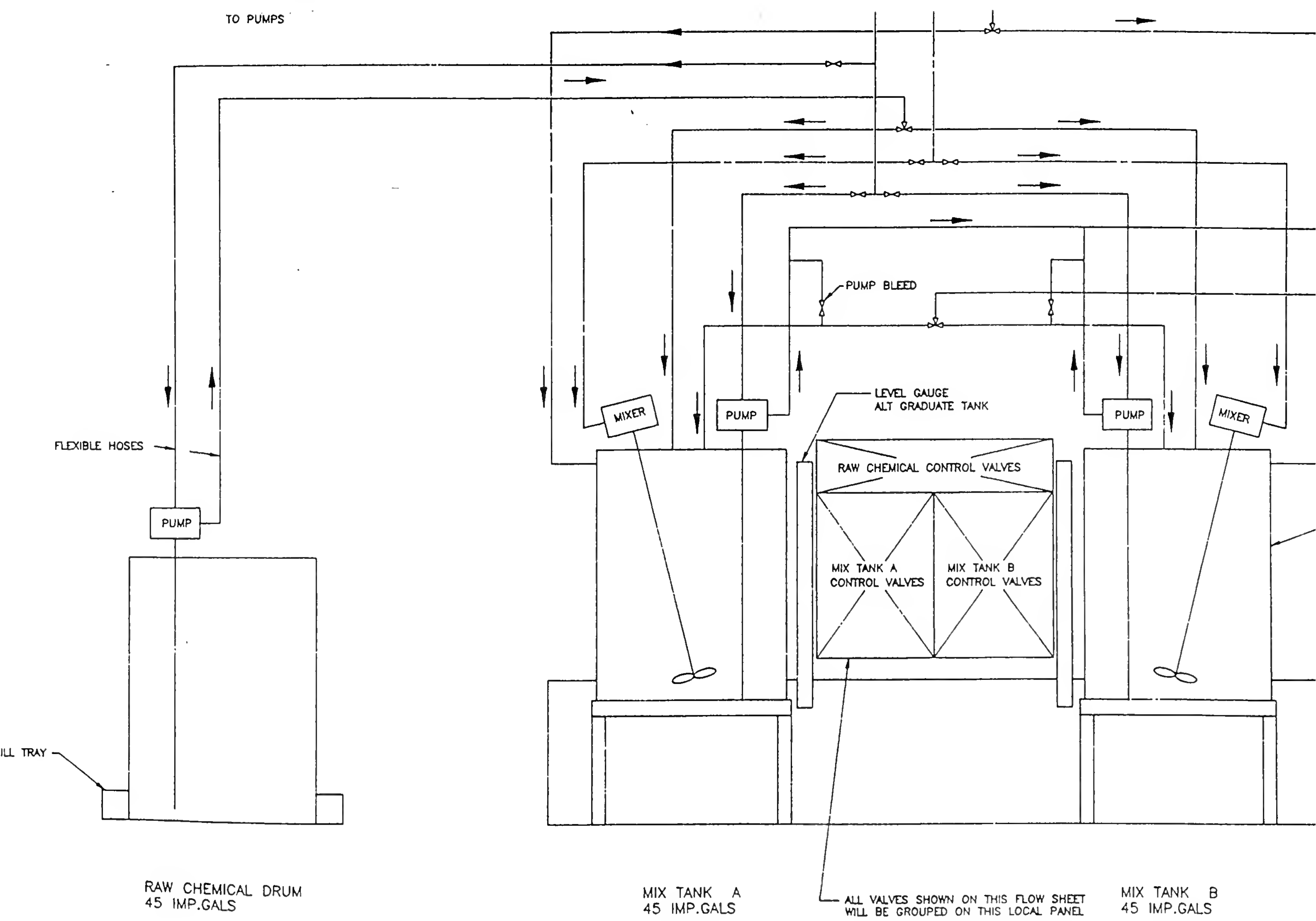
DRAWN BY	CHECKED BY	APPROVED BY	SCALE	DATE	No.
R.MORGAN			1/16=1FOOT	JUL30/93	382E091

FILE: N:\P1042601\MECH\382E091.DWG

Plot Date FEB 18, 1994 - 07:23:10



PLAN BELOW MEZZANINE
25
24
23a
23
22
21
20
B
B
ELEV.117'-11 1/2"
FINISH COATER CONTROL PANEL
PLENUM
NEW PLATFORM
ST #B RELOCATED
DRIVE
15'-0"
2'-0"
ST # 6
C
C
DRYING CHAMBER
STRIP TRAVEL
16'-10"
5'-0" STRIP
ACCESS DOOR
A
RECIR FAN
14'-9"
8'-9"
EXTENT OF EXISTING PLATFORM
10'-2"
60'-0"
5'-4 1/2"
4'-1 3/4"
8" BLOCK WALL


TO PUMPS
FLEXIBLE HOSES
PUMP
ILL TRAY
MIXER
PUMP
PUMP BLEED
LEVEL GAUGE
ALT GRADUATE TANK
PUMP
MIXER
RAW CHEMICAL CONTROL VALVES
MIX TANK A
CONTROL VALVES
MIX TANK B
CONTROL VALVES
RAW CHEMICAL DRUM
45 IMP.GALS
MIX TANK A
45 IMP.GALS
ALL VALVES SHOWN ON THIS FLOW SHEET
WILL BE GROUPED ON THIS LOCAL PANEL
MIX TANK B
45 IMP.GALS

382 E 092